

ART. LVI.—Notes on the possible age of some of the Mesozoic rocks of the Queen Charlotte Islands and British Columbia; by J. F. WHITEAVES.

As far back as the year 1869, Mr. W. Gabb expressed the opinion that the Californian rocks, to which he gave the provisional name of the "Shasta Group," were probably the equivalents of the Gault and Neocomian of Europe, and this view was endorsed by Prof. J. D. Whitney. On behalf of the Canadian Survey Mr. J. Richardson visited the Queen Charlotte Islands in 1872, and made a small but interesting collection of fossils from the coal-bearing deposits of Skidegate Inlet. Among the species recognized at this locality were *Ammonites Breweri*, *A. Stoliczkanus* and *Aucella Piochii* of Gabb, of the Shasta group of California, also *Ammonites Timotheanus* Mayor, and *Inoceramus concentricus*, of the European Gault, but associated with these were several new *Ammonites* which appeared to have rather a Jurassic facies. The conclusion reached on this rather meagre and unsatisfactory evidence was that the rocks bordering Skidegate Inlet could scarcely be much older than the Upper Jurassic or much newer than the Middle Cretaceous.

Four years later Dr. G. M. Dawson obtained a small series of fossils from the bedded volcanic rocks at the Iltasyouco River and Sigutlat Lake, in the Coast Range of British Columbia. Having then no reason to doubt the correctness of Mr. Meek's conclusion that certain rocks in the Black Hills of Dakota were of Jurassic age, the writer of the present article at once assumed that the Iltasyouco and Sigutlat fossiliferous strata were also Jurassic, on account of their holding such fossils as *Gryphæa Nebrascensis*, *Volsella formosa*, *Astarte Packardi*, *Pleuromya subcompressa*, and the like.

The exact age of the "*Aucella* schists" of Russia, Siberia, etc., has been the subject of much discussion, and European geologists are still at issue on this point. D'Orbigny, in 1846, places them in the "Oxfordien" division of the Jurassic. Trautschold (1864 and 1866) claimed that they are about the age of the Kimmeridge Clay, but later (in 1875) placed them at the extreme summit of the Jurassic system, in the Tithonic Group of Oppel, and this latter view is also maintained by Rudolph Ludwig. Ever since 1867, however, Eichwald has strenuously argued that they are Neocomian, and in the only geological section of these rocks which the present writer has seen, the *Aucella* schists are represented as immediately and conformably overlying the Kimmeridge Clay, as the Gault does at Culham in Berkshire (England), a circumstance which many of those who attended the late Prof. Phillips's geology class at

Oxford will remember. Since 1875, deposits holding large numbers of *Aucella Piochii* Gabb (which can scarcely be distinguished from the *A. Mosquensis* of Europe), with a few other fossils, have been discovered by members of the Canadian Survey at several localities on the west coast of British Columbia, on Vancouver Island at Forward Inlet, and in the valley of the Peace River. In a paper "On the Lower Cretaceous rocks of British Columbia" published in the first volume of the Transactions of the Royal Society of Canada, the writer expressed the opinion that those deposits in California and British Columbia, which are characterized by the presence of *Belemnites impressus*, *Ancyloceras percostatus* and more especially by an abundance of *Aucellæ*, represent the lower half of the Shasta Group and are the equivalents of the Upper Neocomian of Europe.

In 1878 Dr. G. M. Dawson, accompanied by his brother, visited the Queen Charlotte Islands and devoted the whole season to an examination of their geological features. From his detailed report upon these islands, which was published in 1879, it appears that the central portion, which includes both shores of Skidegate and Cumshewa Inlets, is occupied by strata which there is now every reason to believe are of Cretaceous age. In descending order the section of these Cretaceous rocks given by Dr. Dawson is as follows. No. 1. The Upper Shales; these have so far yielded only several specimens of *Inoceramus problematicus*, and are therefore supposed to represent the base of the Upper Cretaceous. No. 2. Coarse Conglomerates; these have as yet afforded no fossils that can be identified, but from their position may be assumed to be the equivalents of the Dakota Group. No. 3. The Lower Shales; with coal and iron ore and an abundance of fossils, of which upwards of seventy species have now been described. No. 4. Agglomerates, with a few very indistinct fossils, and No. 5. The Lower Sandstones; these two, from their faunal relations, are believed to be only minor subdivisions of No. 3.

The Lower Shales, or sub-division 3 of Dr. Dawson's report, contain a very rich and varied fauna quite unlike that of any other Cretaceous deposits heretofore recognized in North America. These shales, which the writer has elsewhere ventured to designate "The Queen Charlotte Island Series," are believed to represent the upper part of the Shasta Group of California and the Gault of Europe. Among the fossils which they hold in common with the Shasta Group are *Haploceras Breweri*, *Lytoceras Batesi*, *Hoplites* (?) *Stoliczkanus*, and *Ancyloceras Rémondi*. They have yielded such characteristic Gault species as *Schloenbachia inflata*, *Haploceras Beudanti*, *planulatum* and *Timotheanum*, *Lytoceras Sacya* and *Thetis major*, var., often in large numbers, also an abundance of *Inoceramus concentricus* and *Actino-*

ceramus sulcatus. As might have been expected, out of the seventy or more species which they contain, a few range upward into the Chico Group of the Upper Cretaceous, and at least three into the lower division of the Shasta Group, which for that reason is supposed to represent the Upper rather than the Lower Neocomian. But, associated with what appear to be purely Cretaceous types, the Lower shales of Skidegate and Cumshewa Inlets hold also at least four or five new species of Ammonites which have recently been described from unusually perfect and well preserved specimens, and which seem to belong to genera, to sections of genera, or to species, which in Europe would be regarded as exclusively Jurassic in their character.

Moreover it is now quite clear that the fauna of the Ilta-youco River and Sigutlat Lake rocks, which the writer at first regarded as of Jurassic age, is essentially the same as that of the Lower shales of Skidegate and Cumshewa inlets. In the coal-bearing strata of the Queen Charlotte Islands and in the volcanic rocks of the Coast Range of British Columbia, associated with characteristic Cretaceous invertebrates, about a dozen species of fossil mollusca have been collected, which the present writer, after long and careful study, has been unable to separate specifically from fossils which Meek and Dr. White have described as Jurassic. A similar apparent mixture of "Jurassic" and Cretaceous fossils occurs in rocks immediately overlying the Alpine Trias, on the Peace River.

Judging exclusively by the invertebrate fossils which they contain and by the stratigraphical position which they are said to occupy, the writer, in a recently published report,* has given at some length his reasons for thinking that the Jurassic age of certain strata in Dakota, Montana, etc., is not yet conclusively proved. The evidence afforded by the vertebrates of these rocks is quite another question and one which has to be considered on its own merits. This aspect of the case has not been discussed at all in the report referred to, for the simple reason that there is not a vestige of a vertebrate, not even a fish scale, in the collection reported on.

In a paper "On the Jurassic Strata of North America," published in the March number of this Journal, Dr. C. A. White objects to the present writer's suggestion that some of the supposed Jurassic rocks of the Western States may possibly be of Middle Cretaceous age, and to the identification of a few fossil mollusca upon which this suggestion was based.

Dr. White's long experience as a paleontologist and his extensive knowledge of the fossil invertebrates of the United

* Mesozoic Fossils, vol. i, Part 3; On the Fossils of the Coal-Bearing Deposits of the Queen Charlotte Islands, collected by Dr. G. M. Dawson in 1878. Montreal, 1884.

States and Territories entitle any views he may express on such subjects to the fullest consideration, and his intimate acquaintance with and ready access to Meek's types from the Black Hills are unquestionably a great advantage. Unfortunately, however, Dr. White could only spare part of a single day for the examination of the large series of Mesozoic and Laramie fossils in the Museum of the Canadian Survey at Ottawa, and only a few minutes each to a study of those species whose identification he objects to.

To the general statements made at the commencement of Dr. White's paper no special exception need be taken here except perhaps on the ground of their want of novelty. They are, in effect, a résumé of that part of Clarence King's volume on the "Systematic Geology" of the United States Exploration of the 40th Parallel which treats of the Jurassic rocks. In that volume, however, Prof. King distinctly states that the Dakota and "Jurassic" rocks are conformable in the Wahsatch Region, also that according to Meek, Hall and Whitfield, the "Jurassic" fossils from the east base of Augusta Mountain have "a Cretaceous and even an Eocene look."

To Dr. White's presentation of the statements and arguments on the other side of the question the writer begs respectfully to demur.

Dr. White says that in the memoir which he criticizes the author thereof "describes and figures *some* fossils" which are "*reported* to come from certain strata," etc., thereby leading any reader who is ignorant of the facts to suppose that the number of specimens is small and that it is not altogether certain where they came from. Not counting the fossils previously brought back by Mr. Richardson, Dr. G. M. Dawson's collection alone consists of upwards of one thousand specimens, every one of which is labeled not only with its exact locality but also with the precise subdivision of the series in which it was found.

Out of the twelve forms collected by Dr. Dawson which the writer has referred to North American "Jurassic" species, Dr. White objects to the identification of nine, and with regard to these the following remarks are submitted :

1. *Belemnites densus* Meek and Hayden. The specimens described by Mr. Meek under this name are represented as being short and thick or long and slender, as having an apical groove, a median groove or no groove at all. Dr. White says that "Mr. Whiteaves' collection contains only one specimen which he refers to this species," whereas there are two of the short and thick form, seven of the long and slender variety (to which in accordance with a suggestion of Mr. Meek's, the writer gave a local and provisional name) and several large phragmocones.

Moreover this series was directly compared with authentic specimens of *B. densus* from Dakota, received from Mr. Meek, and it was found necessary to mark all the fossils from the two localities as it would otherwise have been impossible to separate them.

2. *Lyosoma Powellii* White. The fact that the writer gave a different generic and specific name to *Vanikoro pulchella* is a sufficient indication that the analogy between it and *L. Powellii* was supposed to be more remote than that which is supposed to obtain in any of the other instances cited.

3. *Pleuromya subcompressa* Meek. The type of this species was figured by Meek in 1873, and since then Dr. White has illustrated three well marked varieties of it. Specimens which agree perfectly with the descriptions and figures of three out of these four forms have been collected at the Queen Charlotte Islands, and two at the Iltasyouco River and Sigutlat Lake.

4. *Astarte Packardii* White. Dr. White admits that, as far as external shape and surface markings are concerned, it is scarcely practicable to separate the British Columbia and Queen Charlotte Island specimens from this species, but says that the hinge and interior markings of the type of *A. Packardii* are unknown. In this genus, as every experienced malacologist is aware, the interior of the valves affords a certain indication of its generic relations but is of very little assistance in the determination of species.

5. *Grammatodon inornatus* Meek and Hayden. Dr. White says that "Mr. Whiteaves' specimens do not show the hinge." This is quite correct as regards the fossils from the Queen Charlotte Islands, but one of the specimens from the Iltasyouco River shows the impression of two short posterior lateral teeth parallel to the hinge line, just as in Meek's figure of *G. inornatus* on plate 3, fig. 9b, of the "Palæontology of the Upper Missouri."

6. *Modiola (Volsella) subimbricata* Meek. The specimens from the Queen Charlotte Islands referred to this species, though somewhat distorted, are nearly perfect single valves. Dr. White does not comment at all on the real or supposed identification of a Sigutlat Lake specimen with the *Modiola* (or *Volsella*) *formosa* of Meek and Hayden, one of the strongest points in the writer's view of the case. At the Iltasyouco River, too, specimens have been found which are very difficult to distinguish from *Modiola platynota* White.

7. *Pteria (Oxytoma) mucronata* Meek and Hayden. Of this the writer is said to have only one imperfect valve and Dr. White adds "that the most that can be said of it is that it apparently indicates a form which is much like the *P. (O.) mucronata* of Meek and Hayden." In answer to this statement

it may be observed that while only one imperfect valve was collected in Alliford Bay, yet several perfect specimens of both valves were obtained at Maud Island. In the writer's judgment the least that can be said of the whole of the specimens collected by Dr. Dawson is that they agree perfectly with Meek's description and figure of *Pteria* or *Oxytoma mucronata*.

8. *Camplonectes extenuatus* Meek and Hayden. The lower valve of a small *Pecten* from Maud Island which was somewhat doubtfully identified with this species is quite perfect in marginal outline, has most of the test preserved, with its characteristic sculpture, and shows the shape of both ears. An upper valve, from the Itasyouco River, corresponds remarkably well with Meek's figure of the type of *C. extenuatus*.

9. *Gryphaea Nebrascensis* Meek and Hayden. Dr. White says that the specimens, regarded by the writer as probably identical with this species, are more like *Gryphaea navia* Conrad. The irregular, radiating striæ on the umbonal region which are characteristic of *G. Nebrascensis*, and which are well seen on specimens from the Queen Charlotte Islands and from the Itasyouco River, are altogether absent in *G. navia*, which latter shell has also a narrowly subtrigonal outline with angulated beaks and a sharp umbonal ridge, a combination of characters which is not seen in *G. Nebrascensis*, nor on any of the specimens collected by Dr. G. M. Dawson.